

unpatentable over Noda in view of Ueno and Applicant's Figure 8; and Claim 8 was indicated as allowable if rewritten in independent form including all of the limitations of its base claim and any intervening claims.

Applicant thanks the Examiner for the indication of allowable subject matter.

Claims 1-6 were rejected under 35 U.S.C. § 103(a) as unpatentable over Noda in view of Ueno. That rejection is respectfully traversed.

Claim 1 is directed to a semiconductor device having a semiconductor element mounted on a first side of a lead frame, a metal block on a second side of the lead frame, and an insulation layer on the metal block. The metal block improves a heat dissipation characteristic of the whole semiconductor device because of the heat diffusion effect of the metal block.¹

In a non-limiting example, Figure 1 shows the semiconductor element 1, the lead frame 2a, the metal block 5, and the insulation layer 7.

Noda discloses in Figure 1 and at column 9, line 63, to column 10, line 6, a heat sink 104 that improves heat dissipation characteristics of a whole semiconductor device. The heat sink 104 is placed under a circuit pattern layer 106 with an insulator layer 105 disposed between the heat sink 104 and the circuit pattern layer 106. The outstanding Office Action asserts that the circuit pattern layer 106 is provided for dissipating a heat of the semiconductor device.²

Ueno shows in Figure 2 a heating element 1 having a radiator 41 with a protrusion portion 5 placed under a semiconductor device 1. Based on the device in Ueno, the

¹ Specification, page 12, line 10 to page 13, line 5.

² Outstanding Office Action, page 5, lines 12-14.

outstanding Office Action states that one skilled in the art would make the circuit pattern layer in Noda a metal block to provide good heat characteristics for the semiconductor device.

Further, the outstanding Office Action states on page 5, lines 12-14, that the circuit pattern layer 106 of Noda and the radiator 41 of Ueno have the same function, which is to provide a good heat dissipation for the semiconductor package device.

Because the circuit pattern layer 106 of Noda includes metal, the circuit pattern layer 106 has a good thermal conductivity. However, since the circuit pattern layer 106 is a foil, and this foil is very thin, it is respectfully submitted that the circuit pattern layer 106 does not have the function of *dissipating heat*. In other words, the circuit pattern layer 106 does not have the function of spreading heat in a vertical direction with respect to a thickness of the circuit patter layer 106.

To the contrary, in the device recited in Claim 1, the heat generated from the power element is diffused in the vertical direction with respect to the thickness of the metal block by the metal block and an area over which heat passes through an insulation layer is sufficiently large, thereby improving the heat dissipation characteristic.³

Therefore, the heat generated from the power device 101 of Noda merely passes through the circuit pattern layer 106, and thus that heat is not diffused by the circuit pattern layer 106. Further, the circuit pattern layer 106 functions only as a circuit pattern that transmits electrical signals, and thus the circuit pattern layer 106 does not provide a good heat dissipation for the device of Noda. Rather, the heat sink 104 of Noda provides a good heat dissipation.

³ Specification, page 12, line 21, to page 13, line 5.

Therefore, it is respectfully submitted that the circuit pattern layer 106 of Noda and the radiator 41 of Ueno do not have the same function, but the heat sink 104 of Noda and the radiator 41 of Ueno have the same function.

Further, Ueno does not teach or suggest that the radiator 41 functions as a circuit pattern. Hence, even if the device of Noda is modified to provide a radiation structure similar to the device of Ueno, one of ordinary skill in the art would replace the heat sink 104 and not the circuit pattern layer 106 in Noda with the radiator 41 from Ueno. As a result, the modified device of Noda in view of the device of Ueno would not have the same structure as the device recited in Claim 1.

Thus, it is respectfully submitted that one of ordinary skill in the art could not find any suggestion in the combined teachings of the applied art to arrive at the device recited in Claim 1. In such ways, Claims 1-6 and 8 clearly patentably distinguish over the combination of teachings in Ueno in view of Noda.

Claim 7 was rejected under 35 U.S.C. § 103(a) as unpatentable over Noda in view of Ueno and Applicant's Figure 8. That rejection is respectfully traversed.

Applicant's Figure 8 is asserted in the outstanding Office Action at page 4, item 3, for teaching that a surface of a block is closer to a lead frame than another surface of the block. As discussed above, one of ordinary skill in the art could not find any suggestion in the combined teachings of the applied art to arrive at the device recited in Claim 1. Thus, even if Applicant's Figure 8 shows that the first surface of the metal block is closer to the lead frame than the second surface of the metal block, it is respectfully submitted that the features claimed in Claim 7 are not obvious in view of the applied art.

Further, Claim 7 depends directly on independent Claim 1, which is believed to be allowable. Accordingly, Applicant respectfully submits that Claim 7 patentably distinguishes over the applied art.

Furthermore, it is respectfully requested that this response be entered as it is believed no new issues have been raised.

Consequently, in light of the above discussion, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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